

**California
Commission on Teacher Credentialing**

**Meeting of
June 6, 2002**

AGENDA ITEM NUMBER: **PREP - 2**

COMMITTEE: **Preparation Standards Committee**

TITLE: **Proposed Exploration for the Restructuring of the
Single Subject Credential for Mathematics Teachers**

X **Action**

 Information

 Report

Strategic Plan Goal(s):

- Goal 1:** **Promote educational excellence through the preparation and certification of professional educators**
- Sustain high quality standards for the preparation of professional educators
 - Sustain high quality standards for the performance of credential candidates

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Proposed Exploration for the Restructuring of the Single Subject Credential for Mathematics Teachers

Professional Services Division

May 17, 2002

Executive Summary

There is a need to increase the number of fully certified single subject mathematics teachers in the State of California. Of the approximately 16,000 mathematics teachers in California's public schools during the 2000-2001 school year, nearly 2200 were teaching under emergency permits or waivers. That year, only 704 mathematics teachers were certified (preliminary and professional clear, including those from out of state programs) in California. Class size reductions in ninth grade mathematics courses have made the shortage of fully certified teachers more severe. The K-12 student academic content standards in mathematics have recently raised expectations as to what mathematics all students should know, requiring their teachers to have more content preparation, especially at the middle school level. As California moves toward including algebra and geometry content in the middle school mathematics curriculum (requiring teachers with single subject mathematics credentials), the demand for mathematics teachers will increase.

At its May 2001 meeting, the Commission authorized a field study that would explore the impact of a two-tiered mathematics credential. The purpose of this agenda item is to provide a summary of the data gathered from the study and seek direction from the Commission about the options to be considered for increasing the pool of individuals who are qualified to teach the mathematics courses in which the majority of students are enrolled.

Fiscal Impact Summary

Implementing the recommendations in this report can be accomplished within the base-budget of the Professional Services Division.

Recommendation

Staff recommends that:

1. The single subject mathematics credential be bifurcated into a basic and an advanced level;
2. The examination to determine subject matter competency be adapted to allow for an examination route for the basic and advanced level of credential.
3. The current single subject mathematics panel be charged with identifying appropriate Subject Matter Requirements for each mathematics credential level and the courses that would be authorized to be taught under each credential.

Proposed Exploration for the Restructuring of the Single Subject Credential for Mathematics Teachers

Professional Services Division

May 17, 2002

Background

There is currently a need to increase the number of fully certified single subject mathematics teachers in the State of California. Of the approximately 16,000 mathematics teachers in the State of California during the 2000-2001 school year, nearly 2200 were teaching under emergency permits or waivers. That year, only 704 mathematics teachers were certified (preliminary and professional clear, including those from out of state programs) in California. Class size reductions in ninth grade mathematics courses have made the shortage of fully certified teachers more severe. The K-12 student academic content standards in mathematics have recently raised expectations as to what mathematics all students should know, requiring their teachers to have more content preparation, especially at the middle school level. As California moves toward including algebra and geometry content in the middle school mathematics curriculum (requiring teachers with single subject mathematics credentials), the demand for mathematics teachers will increase.

Teacher candidates in California are required to demonstrate competence in the subject matter they will be authorized to teach. Candidates have two options available for satisfying this requirement. They can either complete a Commission-approved subject matter preparation program or they can pass the appropriate Commission-adopted subject matter examination(s). The Single Subject Mathematics Credential authorizes the holder to teach mathematics at all levels. The current subject matter requirements for mathematics reflects this broad authorization and includes substantial content of mathematical concepts at a very advanced level. Consequently, a credentialed mathematics teacher is fully authorized and has been prepared to teach all mathematics courses, including calculus and other advanced courses. Yet, in the 1999-2000 school year, more than 97% of high school mathematics classes (enrolling 97% of all mathematics students) were below calculus or other advanced course level. This means that at present mathematics teachers are required to be prepared to teach courses that they are unlikely to teach.

One possible way to increase the number of appropriately prepared mathematics teachers would be to modify the mathematics credential. A change in the structure of the credential and in the content requirements for teachers might encourage more prospective mathematics teachers to obtain certification. Concurrent changes in the exam route to demonstrating subject matter competency might also reduce the barriers to certification for career changers.

Since March 2001, the Commission staff have been engaged in an effort to align the content requirements of the subject matter preparation programs and subject matter examinations with the academic content standards for students in grades K-12 in English, mathematics, science, and social science. The Executive Director appointed subject matter panels in each of these areas to

advise Commission staff on the development of new subject matter program standards and examinations in these subject areas. The mathematics advisory panel has been developing recommendations for new program standards and exam specifications and has explored ways to increase the number of individuals who are qualified to teach the majority of basic and intermediate courses offered in middle schools and high schools throughout the state.

While the panel has indicated its commitment to high subject matter standards for mathematics teachers, it is concerned that current subject matter standards may not focus on knowledge that is most applicable to K-12 teaching, particularly at the level of coursework most commonly undertaken by students at the middle school and high school levels (e.g., pre-algebra, algebra and geometry). In that current subject matter requirements include advanced concepts not directly applicable to most K-12 instruction (e.g., real analysis, topology, differential equations) the panel has expressed an opinion that these requirements create an artificial barrier to mathematics certification, dissuading or preventing prospective mathematics teachers from obtaining their credentials.

In its deliberations, the Single Subject Mathematics Advisory Panel has explored possible changes in the existing credential structure and in content requirements that might encourage more individuals to obtain mathematics certification. The panel has considered separating the credential into a basic and advanced level. Under such a credential structure, a basic credential would authorize the holder to teach basic and intermediate level mathematics courses, while an advanced credential would authorize the teaching of advanced mathematics courses as well.

At its May 2001 meeting, the Commission authorized a field study that would explore the impact of a two-tiered mathematics credential. The purpose of this item is to provide a summary of the data gathered from the study and seek direction from the Commission about the options to be considered for increasing the pool of individuals who are qualified to teach the mathematics courses in which the majority of students are enrolled.

Study Background

During Fall 2001, Commission staff developed surveys for the purpose of gathering responses from field about the potential impact of a two-tiered credential structure. In developing the survey instruments, input was sought from the single subject mathematics panel, the Association of California School Administrators (ACSA), and mathematics education specialists at the State Department of Education (SDE). Different versions of the surveys were developed for *human resource directors* of school districts, *high school and middle school principals*, *high school and middle school mathematics teachers*, *mathematics faculty* at institutions that have Commission-approved mathematics subject matter programs, and *mathematics education faculty* at institutions with single subject credential programs.

Survey questions were designed around the following key policy issues:

- The projected impact a two-tiered credential would have on the work of district administrators and school site principals

- The impact a two-tiered credential system would have on the pool of potential mathematics teachers
- Whether respondents favored the idea of a two-tiered mathematics credential
- What subject matter content should be required of prospective mathematics teachers and the kinds of courses in a middle school or high school setting that would be authorized by the basic mathematics credential.

All survey versions included a cover letter that provided background information on the need for more qualified mathematics teachers and explained how to complete and return the survey. Surveys were sent to sample populations from each of the groups identified above in early January 2002, with a one month response time allowed. In addition, the surveys were also placed on the Commission's web site for other interested parties to download and return.

Numbers of Survey Responders

Table 1 shows the number of surveys that were sent and returned and those that were downloaded from the CTC web site or other electronic source (e.g, email sent by the Association of California School Administrators to its membership) and returned. Only the District Administrators (Human Resource Directors or equivalent positions) data included substantial numbers of downloaded surveys. No differences in patterns of responses were noted between the administrators who were sent surveys and those receiving their surveys electronically, and data are reported for the combined total. The number of responses were judged sufficient to provide insight into professional responses to the proposed credentialing changes.

Table 1. Surveys Sent, Downloaded, and Returned.

Recipients	Sent	Downloaded	Total Returned
Human Resource Directors	98	25	58
Middle & High School Principals	513	6	166
Middle & High School Math Teachers	576	49	342
Mathematics Faculty	49	4	31
Mathematics Education Faculty	74	2	21

Respondents with Shortages of Fully-Certified Mathematics Teachers

Field responses were received from a range of respondents, including some from districts or schools that were affected by a mathematics teacher shortage. In analyzing the responses, a district or school was considered to be affected by a mathematics teacher shortage if the estimated percent of less than fully certified mathematics teachers was greater than 20%.

In the surveys for administrators (human resource directors and principals), respondents were asked to estimate the approximate percent of less than fully certified mathematics teachers

serving as the teacher of record at the middle school level and in the basic and advanced levels of high school mathematics courses. Thirty eight percent (38%) of responders stated that their district/school had such a shortage at the middle school level. Twenty eight percent (28%) cited shortages at the high school basic mathematics course level and 13% at the high school advanced course level. The surveys did not define precisely what courses were in the basic and advanced levels. **Impact of a Two-Tiered Mathematics Credential System on the Potential Pool of Mathematics Teachers**

Surveys to all groups of responders asked for a response to the question: Do you believe that a two-tiered mathematics credential would increase the potential pool of well qualified mathematics teachers for middle school level, basic high school level, and advanced high school level mathematics courses? Table 2 gives the percent responses for each group to this question.

Table 2. Would a Two-Tiered Mathematics Credential Increase the Potential Pool of Mathematics Teachers (by Course Level)?

	Middle School			High School Basic			High School Advanced		
	Yes	No	Unsure	Yes	No	Unsure	Yes	No	Unsure
HR Directors	65%	24%	11%	61%	22%	18%	20%	50%	30%
Principals	67%	18%	15%	69%	18%	13%	30%	46%	24%
Math Teachers	73%	9%	18%	69%	14%	17%	25%	51%	24%
Math Faculty	68%	16%	16%	48%	26%	26%	0%	87%	13%
MathEd Faculty	68%	21%	11%	74%	21%	5%	20%	75%	5%

Response patterns were similar for all five groups of responders, showing that responders believed a two-tiered credential would increase the potential pool of teachers for middle and basic high school courses, and a lesser belief in the pool increase for teachers of advanced high school mathematics courses.

Support for a Two-Tiered Mathematics Credential

All groups were also asked to respond to the question: Do you favor the creation of a two-tiered mathematics credential? Table 3 gives the number and percent responses for each group to this question.

Table 3. Numbers of Responders and Percents of Support for a Two-Tiered Mathematics Credential

	Yes		No		Unsure	
	Number	%	Number	%	Number	%
HR Directors	34	62%	13	24%	8	15%
Principals	104	63%	27	16%	35	21%
Math Teachers	224	66%	46	14%	68	20%
Math Faculty	8	28%	12	41%	9	31%
Math Ed Faculty	13	62%	4	19%	4	19%

More than 60% of administrators, principals, mathematics teachers and mathematics education faculty supported the creation of a two-tiered mathematics credential. Lesser support was given by the mathematics faculty responders. Within this group less than half responded negatively to the creation of such a credential.

Basic Mathematics Credential Preparation and Courses Authorized to Be Taught

The three groups of mathematics educators (middle and high school mathematics teachers, mathematics faculty and mathematics education faculty) were asked to identify the types of mathematics subject matter knowledge that should be required for a basic mathematics credential. Content areas were identified by commonly used labels for the areas most often found within mathematics subject matter programs (e.g., number theory, mathematical proof, differential equations). Of the 14 topics listed, all three groups agreed on the inclusion of seven topic areas (college algebra, pre-calculus, number theory, probability, statistics, modern geometry, and history of mathematics) and the exclusion of one (advanced calculus). The mathematics and mathematics education faculty also supported inclusion of calculus and mathematical proof. There was less support for inclusion of linear algebra, differential equations, abstract algebra and discrete mathematics.

Given their responses to what would constitute appropriate subject matter preparation for a basic credential, the three groups of mathematics educators were also asked to identify the mathematics courses that a basic mathematics credential would be authorized to teach. Again, responses were on a 5 point Likert Scale from "can be taught" to "cannot be taught," with mean scores of 1-2.5 considered as supporting the authorization for teaching of that course, and scores over 3.5 considered as a non-supportive for authorization. The course choices were taken from the areas identified in the K-12 student academic content standards and frameworks that are typically taught in high schools. All three groups agreed that algebra and geometry could be taught with a basic mathematics credential, and that linear algebra, mathematics analysis, advanced placement probability and statistics, and calculus could not. There was support by mathematics and mathematics education faculty for the teaching of algebra 2, and less support generally for probability and statistics and trigonometry.

The above data are a reasonable starting point for discussions to determine the level of mathematics knowledge required and courses authorized to be taught by holders of a basic mathematics credential, should the Commission approve creation of a two-tiered mathematics credential. They have the following limitations:

- Course titles were used as surrogates for the Subject Matter Requirements (SMRs) currently under development by the single subject mathematics panel. The possible basic and advanced level credentials should be referenced to those SMRs.
- Presumably, respondents had little opportunity to discuss the possibilities and consequences of such a bifurcated credential, especially across the three groups of mathematics educators. Such discussions are an essential part of developing specific proposals for a bifurcated credential.

Impact of a Two-Tiered Mathematics Credential on the Work of District/School Administrators

One issue of concern noted by ACSA has been the possible affect of a two-tiered mathematics credential on the work of district and school administrators. The surveys to these groups asked specific questions about the perceived impact of a two-tiered mathematics credential on their work. Human resource directors were asked about how the two-tiered system would affect assigning teachers to schools, monitoring assignments in mathematics, and bargaining with the union. Middle and high school principals were asked how the two-tiered credential would impact their assignments of teachers to courses and to describe other areas of potential change. Responses are summarized in Table 4:

Table 4. Potential Impact on District and School Administrators of Creating a Two-Tier Math Credential.

Position	Task	Some Change	No Change
HR Directors	Assign Teachers to Schools	65%	35%
	Monitor Assignments	58%	42%
	Bargaining	19%	81%
Principals	Assign Teachers to courses	56%	44%

Opinions varied about the nature of these changes. Some saw the two-tiered system as increasing their assignment flexibility, while others anticipated a decrease in flexibility. The outcome varied for some depending on whether they saw the potential change as increasing or decreasing the pool of potential teachers. Administrators raised issues about the number of regulations that might result, the additional workloads in hiring more mathematics teachers, and possible reclassifications of existing personnel. A rich set of administrator comments were captured and analyzed from the surveys, providing insight into how to work effectively with administrators to minimize potential negative impacts of the proposed change in the mathematics credential. Recall that both administrators groups favored the creation of the two tiered credential.

Summary

The survey responses indicate that there is support for a two-tiered mathematics credential. Respondents view a basic and advanced credential structure as a means of increasing the pool of individuals who are certified to teach mathematics, by enhancing opportunities for mathematically-adept individuals to become qualified to teach basic and intermediate mathematics courses in a middle school or high school setting.

Many respondents took advantage of the opportunity to make comments on their returned surveys, explaining the rationale for their responses, and elaborating on the issues that a two-tiered system would present. Many of the comments centered on the issues of teacher quality, and the adequacy of content preparation for the lower level mathematics courses, with strong opinions expressed on both sides of the argument. For others, the quantity issue was paramount,

again with assertions on both sides as to the overall affect on the pool of legitimizing a pathway that focused on the mathematics preparation of content taught in earlier high school mathematics courses. There seemed to be less disagreements about the benefits of a two-tiered system to middle school mathematics teachers (their quality and size of the pool). Other comments focused on the practicalities of creating a two-tiered system, and the adjustments that would be needed to implement it successfully. These comments have been summarized, with the summaries and raw data made available for future discussions on the two-tiered credential in mathematics.

The state has experienced a shortage of qualified mathematics teachers for several years. Moreover, the demand for credentialed mathematics teachers exceeds the number of individuals who obtain a mathematics credential or supplementary authorization in mathematics each year. The California State University has recently released a report indicating a slow decline in the number of students majoring in mathematics at state university campuses. This shortage is projected to continue in the future due to the relatively small enrollments in mathematics subject matter programs, anticipated growth in the student population, and policy initiatives that will require students to take algebra and geometry earlier in their school careers.

Recommendations

The study results indicate that a two-tiered mathematics credential may enhance opportunities for talented individuals to become credentialed mathematics teachers. In theory, the two-tiered credential structure could lead to an increase the pool of teachers who are qualified to teach basic and intermediate mathematics courses in our public schools. Yet, important policy questions must be answered in order to more fully understand how such a credential structure could be part of the state's strategy to address the shortage of qualified mathematics teachers.

The courses that would be authorized by the basic and advanced credentials remains an important policy question. Which courses in the high school curriculum should be authorized by someone who holds an advanced credential? Which courses in the middle school and high school curriculum should be taught by someone with a basic mathematics credential? There are also important policy questions concerning the content that would be included in a subject matter programs, and implementation strategies in order to mitigate negative impacts on districts or school sites with unique circumstances. How and in what way should the content of a subject matter program leading to a basic credential differ from that required for the advanced credential? The staff recommend that the Commission direct staff to work with the Mathematics Subject Matter panel to identify the appropriate content and authorization levels for each credential and to develop recommendations for implementation strategies for a two-tiered credential.

Given the above field data and prior considerations by the single subject mathematics panel, staff recommends the following actions to the Commission:

1. That the single subject mathematics credential be bifurcated into a basic and an advanced level;

2. That the examination to determine subject matter competency be adapted to allow for an examination route for the basic and advanced level of credential; and
3. That the current single subject mathematics panel be charged with identifying appropriate SMRs for each mathematics credential level and the courses that would be authorized to be taught under each credential.

If the Commission acts in favor of these recommendations, staff will develop specific proposals for the bifurcation of the credential for discussion and action at the July 2002 Commission meeting.